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Invention: STABILIZER FOR A MOTOR VEHICLE

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ABSTRACT

The invention relates to a stabilizer for a motor vehicle. Known one- piece stabilizers are designed either solely for operation in road traffic or solely for off-road operation. Two-piece stabilizers that comprise an engaging and disengaging clutch have disadvantages regarding quality and safety. The invention provides a clutch, drivers (14, 17) of which form at least two adjustable gaps in the peripheral direction. Said gaps can be filled by at least two locking elements (25) that can be displaced to a certain extent. Said locking elements (25) and said drivers (14, 17) are constantly in positive engagement with one another in the peripheral direction and are adjusted to one another in such a manner that the locking elements (25) and the drivers (14, 17) are interlocked without play in the locked final position and that they can be rotated towards one another across a limited angle in the unlocked final position.

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Description

Stabilizer for a motor vehicle

The invention relates to a stabilizer with the features of the preamble of claim 1.

Such stabilizers are employed in motor vehicle technology.

In principle a stabilizer working according to the torsion bar principle is coordinated to each axle of a motor vehicle, wherein the stabilizer runs parallel to the axle and is attached at two ends at a wheel suspension. These stabilizers have the task to prevent or, respectively, diminish the transfer of rolling motions caused by the road situation and starting at the wheels onto the vehicle. Such rolling motions are generated mainly in the curves of the road or at the unevenness of the road, such as for example potholes or ruts.

Single part stabilizers exist, which are constructed in their dimensioning and in their material properties such that they receive torsion forces of a predetermined order of magnitude and that they can furnish corresponding counter forces. Single part stabilizers react however to different loads either too soft or too hard, which is disadvantageous for the driving comfort and single part stabilizers cannot accept increased loads.

Therefore increasingly two part stabilizers are employed, wherein the two part stabilizers are connected to each other by an axially fixed and rotary elastical clutch. Such a clutch is shown for example in the German printed patent DE 43 42 360 C2, wherein a rubber spring element is interposed between the two stabilizer parts. This rubber spring elements exhibits a softer spring constant and the thereby increases the possible twist angle between the two stabilizers. This way larger road loads can be opposed. The twist angle however is insufficient in case of road unevenness problems acting extremely different onto the wheels, such as they occur cross-country. In addition a slippage exists between the two stabilizer parts because of the

rubber spring element, which operates disadvantageously onto the driving behavior in case of a straight driving and planar road.

Increasingly two part stabilizers with a switchable clutch are employed for such extreme load situations, such as there are described for example in the German printed patent document DE 19705809 A1. This coupling is furnished as a friction clutch and is controlled hydraulically depending on the load of the wheels. The two halves of the clutch are frictionally engaged connected in case of a high outer load and are separated in case of a lacking load. A slippage occurs between the two stabilizer halves upon a small load of the wheels. Such friction clutches are not safe, since also a slippage of the clutch cannot be excluded in the closed position and since an unlimited twist angle is possible in the separated position under an exclusion of the stabilizer function. This is a safety risk.

There exists no switchable clutch in all known constructions, which connects the two stabilizer halves without play in the block condition and which safely separates the two stabilizer halves in the released condition and which

admits only unlimited twist angle of as desired plus/minus 40 degrees in the released state.

Therefore, it is an object of the invention to develop a stabilizer of the kind recited, which eliminates the recited disadvantages of the state-of-the-art and which automatically closes in a fail-safe-situation and which does not automatically separate in a coupled state.

This object is accomplished by the characterizing features of claim 1.

Advantageous embodiments of the invention result from the features of the claims 2 through 10.

The invention eliminates the recited disadvantages of the state of the art. A particular advantage results therefrom that the two great deal catches are disposed on the common plane and also remain in a common plane in each operating state and that only the adjustment piston with its locking elements is disposed axially shiftable. A play free and slippage free connection of the

two stabilizer parts occurs thereby in the coupled state. There results further from the arrangement of the two radial catches in the plane that there exist no further force transfer planes, which would shorten the effective length of the stabilizer parts.

The invention is to be explained in more detail in the following by way of an embodiment.

There is shown in:

Figure 1 a simplified presentation of a vehicle axle with a stabilizer,

Figure 2 the invention clutch in a sectional view,

Figure 3 the clutch in a locked state, and

Figure 4 the clutch in an unlocked state in the position of a maximum twist angle with a presentation of the rotary angle limitation.

Each axle of a motor vehicle comprises according to figure 1 in principle the two wheels 1 and one supporting axle 2 carrying the two wheels 1. A subdivided stabilizer 3 with its two stabilizer parts 4 and 5 is disposed parallel to the axle 2, wherein each stabilizer part 4, 5 is connected with a wheel suspension not illustrated of the corresponding wheel 1 and on the other hand to the vehicle body for support position 6. A clutch 7 is disposed between the two stabilizer parts 4 and 5, wherein the clutch 7 connects to each other or separates from each other the two stabilizer parts 4, 5 to a straight continuous stabilizer 3 through a gearing. The connected stabilizer 3 is adjusted in its dimensioning and in its material properties to receive torsion forces introduced through the wheels 1 and to build up corresponding counter forces. These forces are thereby not transferred or at least dampened onto the vehicle body.

The clutch 7 is constructed axially switchable and shape matching. For this purpose the clutch 7 comprises a cylindrical casing 8 with a closed floor 9, wherein a connection pin 10 for one of the two stabilizer parts 4, 5 connects

to the closed floor 9. The bearing position 11 for rotary hinge is disposed on the inner side of the floor 9. The casing 8 is disposed opposite to the floor 9 and is closed fixed against rotation with a cover 12, wherein the cover is furnished with the straight continuous bearing bore hole 13 for a further rotary hinge and with a radial catch 14 protruding into the interior of the cylindrical casing 8. The radial catch 14 is disposed in a radial space between the straight continuous bearing bore hole 13 and the inner wall of the cylindrical casing 8. The radial catch 14 can also be directly connected to the cylindrical casing 8 at the same arrangement. Furthermore a shaft 15 is fitted into the casing 8, wherein the shaft 15 penetrates the interior of the cylindrical casing 8 and on the one hand is rotatably supported in the bearing position 11 in the floor 9 of the casing 8 and on the other hand in the bearing bore hole 13 in the cover of the casing 8. The shaft 15 is connected to the other stabilizer part 4, 5 with the outer disposed pin of the shaft 15. The bearing bore hole 13 in the cover 12 is sealed to the outside by corresponding sealing elements 16. A further radial catch 17 is disposed on the shaft 15, wherein the further radial catch 17 is rotatable with the shaft 15 and is disposed and formed in the same way as the radial catch 14 at the

cylindrical casing 8. The radial catch 14 rests thereby at the cylindrical casing 8 and the radial catch 17 rests thereby on the shaft 15 in a common plane, whereby the two radial catches 14 and 17 are swivelable relative to each other only to a limited extent.

Furthermore a hydraulically actuatable locking piston 18 is disposed in the interior of the cylindrical casing 8, wherein the hydraulically actuatable locking piston 18 is guided axially shiftable and radially rotatable on the shaft 15 and wherein the hydraulically actuatable locking piston 18 subdivides the inner space of the cylindrical casing 8 on the floor side into a pressure spring chamber 19 and on the cover side into a pressure chamber 20. A compression spring 21 is inserted into the pressure spring chamber 19, wherein the compression spring 21 is supported at the floor 9 of the casing 8 and wherein the compression spring 21 loads the locking piston 18. The pressure spring chamber 19 is connected to a hydraulic tank through a leakage oil connector 22. In contrast, the pressure chamber 20 is furnished with a connection to a hydraulic pressure oil supply plant through a pressure oil connector not illustrated. The locking piston 18 is further furnished with

an internal sealing element 23 and with an external sealing element 24, which sealing elements 23, 24 hydraulically seal the pressure chamber 20 against the pressure spring chamber 19.

Two locking elements 25 are formed on the cover side of the locking piston 18, wherein the two locking elements 25 are disposed in the radial free space between the shaft 15 and the wall of the casing 8 in the same way as the two radial catches 14 and 17 and wherein the two locking elements 25 are disposed opposite to each other, that is staggered by 180 degrees. The shape and the dimensions of the two locking elements 25 are tuned in a particular way to the shapes and dimensions of the two radial catches 14 and 17.

Thus the two locking elements 25 have a width which fills without play the two caps between the two radial catches 14 and 17 and the two locking elements 25 have a length, which allows an engagement of the locking elements 25 in the region of the two radial catches 14, 17 in the one end position of the adjustment piston 18. Furthermore the locking piston 18 is furnished with a stroke limitation, wherein this stroke limitation prevents

that the two radial catches 14, 17 and the two locking elements 25 become disengaged in the other end position of the locking piston 18. Therefore, furthermore a positive longitudinal covering of the radial catches 14, 17 and of the locking elements 25 of the locking piston 18 exists in this end position.

The contact faces of the two catches 14, 17 and of the two locking elements 25 disposed opposite to each other and communicating with each other are composed in each case out of a conical face 26 with a smaller angle and a conical face 27 with a larger angle, wherein the conical face 26 with the smaller angle exhibits a larger axially length as compared to the conical face 27 with the larger angle and wherein the conical face 27 with the larger angle is disposed at the respective end of the catches 14, 17 or, respectively, of the locking elements 25.

The conicity of the conus face 26 with the smaller angle allows a connection always free of play of the two catches 14, 17 and of the two locking elements 25. Here the conical angle is selected such that the axial force

component of a radial force entered from the outside does not surpass the spring force of the compression spring 21.

The conical face 27 with the larger angle has an angle of about 45 degrees. The two radial catches 14, 17 obtain a radial play region in the opened position of the locking piston 18 based on the larger cone and based on the longitudinal covering of the two catches 14, 17 and the two locking elements 25 caused by the stroke limitation, wherein the radial play region is limited at two sides by having one of the two radial catches 14, 17 being supported at the other radial catch 14, 17 through in each case one of the two locking elements 25. This state is shown in figure 4. The twist angle possible thereby between the two stabilizer parts 4 and 5 can be adapted to the most different situations of application and amounts to preferably 40 degrees.

The pressure chamber 20 in the cylindrical case 8 is maintained free from pressure under standard road conditions, for example in the street traffic, such that the compression spring 21 loads the adjustment piston 18 and shifts the adjustment piston 18 in the direction of the radial catches 14, 17.

Side contacts between the radial catches 14, 17 and the two locking elements 25 occur. The radial catches 14, 17 are thereby centered and the locking piston 18 is also rotatable such that the two locking elements 25 penetrate to such extent into the intermediate spaces between the two radial catches 14, 17 until the conical faces 26 with the smaller angle come to rest. The locking piston 18 is held in this position by the force of the compression spring 21 over the full load range. The stabilizer parts 4, 5 coupled in this manner behave here like a single part stabilizer.

In case of nonstandard road conditions, as they occur for example cross-country, the torsion region of the coupled stabilizer 3 is not any longer sufficient in order to balance the rolling motions of the wheels. In such cases the pressure chamber 20 of the clutch is subjected to pressure by actuating a pressure supply plant preferably operated hydraulically, such that the locking piston 18 disengages from the contact region of the conical face 26 with the smaller angle against the force of the compression spring 21 and that the locking piston 18 shifts into its end position defined by the stroke limitation. The locking piston 18 is maintained in disposition by maintaining

the hydraulic pressure in the pressure chamber 20. Thus the two stabilizer parts 4, 5 are separated, however the two stabilizer parts 4,5 remain free rotatable relative to each other over a predetermined swivel region. One of the two radial catches 14, 17 in the region of the conical faces 27 with larger angle comes into contact with a locking element 25 and rotates the locking element 25 until the locking element 25 is supported at the conical face 27 with the larger angle of the other one of the two catches 14, 17 in case of different loads of the two wheels of an axle. The two stabilizer parts 4, 5 are again connected to each other in this coupling state such that the two stabilizer parts 4, 5 are in a position to receive torsional forces. The relative twist motion of the two radial catches 14, 17 is dampened in an advantageous way by the hydraulic liquid in the pressure chamber 20 subjected to pressure.

Of course, the hydraulic plant for activating the locking piston 18 can be constructed such that the force of the compression spring 21 is hydraulically supported which leads to an acceleration of the coupling process. The effect of the compression spring remains in case of a failure of the hydraulic plant,

wherein the compression spring maintains the couple state or induces the coupled state.

List of reference characters

1 wheel

2 axle

3 stabilizer

4 stabilizer part

5 stabilizer part

6 bearing position

7 clutch

8 cylindrical casing

9 floor

10 connection pin

11 bearing position

12 cover

13 bearing bore hole

14 radial catch

15 shaft

16 sealing element

17 radial catch

18 locking piston

19 compression spring chamber

20 pressure chamber

21 compression spring

22 leakage oil connector

23 internal sealing element

24 outer sealing element

25 locking element

26 conical face with a smaller angle

27 conical face with a larger angle